

## JOURNALS PUBLISHED BY THE AMERICAN MATHEMATICAL SOCIETY

**Bulletin of the American Mathematical Society** is a bimonthly journal. In 1978 it will contain officially invited addresses presented before the Society, reviews of advanced mathematical books, and research announcements. Communications concerning the Bulletin should be sent to P. R. HALMOS, Dept. of Mathematics, University of California at Santa Barbara, Santa Barbara, CA 93106.

**Proceedings of the American Mathematical Society** is a monthly journal devoted entirely to research in pure and applied mathematics, principally to the publication of original papers of moderate length. A department called Shorter Notes was established for the purpose of publishing very short papers of an unusually elegant and polished character for which there is normally no other outlet. Papers in algebraic and differential topology should be sent to REINHARD E. SCHULTZ, Dept. of Mathematics, Purdue University, West Lafayette, IN 47907; in combinatorics and discrete mathematics to THOMAS H. BRYLAWSKI, Dept. of Mathematics, University of North Carolina, Chapel Hill, NC 27514; in commutative algebra to DAVID EISENBUD, Dept. of Mathematics, Brandeis University, Waltham, MA 02154; in complex variables and analytic number theory to W. E. KIRWAN, Dept. of Mathematics, University of Maryland, College Park, MD 20742 or to LAWRENCE A. ZALCMAN, Dept. of Mathematics, University of Maryland, College Park, MD 20742; in differential equations to RICHARD K. MILLER, Dept. of Mathematics, Iowa State University, Ames, IA 50010; in functional analysis and operator theory to CHANDLER DAVIS, Dept. of Mathematics, University of Toronto, Toronto M5S 1A1, Canada or to RONALD G. DOUGLAS, Dept. of Mathematics, State University of New York at Stony Brook, Stony Brook, NY 11790 or to ROBERT R. PHELPS, Dept. of Mathematics, University College London, Gower Street, London WC1E 6BT, England; in general algebra to ROBERT W. WILSON, Dept. of Mathematics, Rutgers University, New Brunswick, NJ 08903; in general analysis to RICHARD R. GOLDBERG, Dept. of Mathematics, Vanderbilt University, Nashville, TN 37235; in general topology to DAVID J. LUTZER, Dept. of Mathematics, Texas Tech University, Lubbock, TX 79409 or to THOMAS A. CHAPMAN, Dept. of Mathematics, University of Kentucky, Lexington, KY 40506; in geometry to JOSEPH A. WOLF, Dept. of Mathematics, University of California at Berkeley, Berkeley, CA 94720; in group theory to NORMAN BLACKBURN, Dept. of Mathematics, The University, Manchester M13 9PL, England; in logic and foundations to PAUL C. EKLOF, Dept. of Mathematics, University of California at Irvine, Irvine, CA 92717; in probability and other fields to NARESH JAIN, School of Mathematics, 127 Vincent Hall, University of Minnesota, Minneapolis, MN 55455; in real variables to RICHARD A. HUNT, Dept. of Mathematics, Purdue University, Lafayette, IN 47907. All other communications should be addressed to JOSEPH A. WOLF at the above address.

**Mathematics of Computation** is a quarterly journal devoted to original papers in numerical analysis, the application of numerical methods and high-speed calculator devices, the computation of mathematical tables, the theory of high-speed calculating devices, and other aids to computation. In addition, reviews and notes in these and related fields are published. Prospective publications should be sent to the Editor, JAMES H. BRAMBLE, Center for Applied Mathematics, 275 Olin Hall, Cornell University, Ithaca, NY 14853.

**Mathematical Reviews** is a monthly journal devoted to abstracts and reviews of the current mathematical literature of the world. Each volume consists of six regular issues plus an index issue. Abstracts and reviews are grouped under subject headings.

**Transactions of the American Mathematical Society** is a monthly journal devoted entirely to research in pure and applied mathematics and, in general, includes longer papers than those in the PROCEEDINGS. Papers in real analysis (excluding harmonic analysis) and applied mathematics should be sent to ROBERT T. SEELEY, Dept. of Mathematics, University of Massachusetts at Boston, Harbor Campus, Boston, MA 02125; in harmonic and complex analysis to HUGO ROSSI, Dept. of Mathematics, University of Utah, Salt Lake City, UT 84112; in abstract analysis to W. A. J. LUXEMBURG, Dept. of Mathematics, California Institute of Technology Pasadena, CA 91125; in algebra and number theory (excluding universal algebras) to STEPHEN S. SHATZ, Dept. of Mathematics, University of Pennsylvania, Philadelphia, PA 19174; in logic, foundations, universal algebras and combinatorics to SOLOMON FEFERMAN, Dept. of Mathematics, Stanford University, Stanford, CA 94305; in topology to JAMES D. STASHEFF, Dept. of Mathematics, Temple University, Philadelphia, PA 19122; in global analysis and differential geometry to ALAN D. WEINSTEIN, Dept. of Mathematics, University of California at Berkeley, Berkeley, CA 94720; in probability and statistics to DANIEL W. STROOCK, Dept. of Mathematics, University of Colorado, Boulder, CO 80302.

**Memoirs of the American Mathematical Society** is a bimonthly journal constituting a series of paperbound research tracts which are of the same general character as the papers published in the TRANSACTIONS. An issue of the MEMOIRS is made up of one or more numbers; a number contains either a single monograph or a group of cognate papers. Copy is supplied by the author; information on preparation of camera copy may be obtained by writing to the Editorial Department of the American Mathematical Society. Papers should be sent to the appropriate editor of TRANSACTIONS.

**Notices of the American Mathematical Society**, published eight times a year, announces the programs of the meetings of the Society. The NOTICES carries the abstracts of all contributed papers presented at the meetings of the Society and publishes news items of interest to mathematical scientists. All communications should be addressed to the Editor, American Mathematical Society, P.O. Box 6248, Providence, RI 02940. News items and insertions for each issue must be in the hands of the editor on or before the deadline for the abstracts for the papers to be presented in the meetings announced that issue. These deadlines are published regularly on the inside front cover.

**Current Mathematical Publications**, issued biweekly, contains a subject-classified index of papers and books being published currently in mathematics.

### TRANSLATION JOURNALS

**Soviet Mathematics–Doklady** is a bimonthly translation journal containing the entire pure mathematics section of the DOKLADY AKADEMĪ NAUK SSSR, the Reports of the Academy of Sciences in the USSR. DOKLADY publishes 500 articles a year, each about four pages long.

**Mathematics of the USSR–Izvestija**, a bimonthly journal is a cover-to-cover translation of IZVESTIJA AKADEMĪ NAUK SSSR SERIJA MATEMATIČESKAJA, published by the Academy of Sciences of the USSR. This is a journal of current research in all fields of pure mathematics.

**Mathematics of the USSR–Sbornik** is a monthly journal and is a cover-to-cover translation of MATEMATIČESKIĪ SBORNIK (NOVAJA SERIJA), published by the Moscow Mathematical Society and the Academy of Sciences of the USSR. This is a journal of current research in all fields of pure mathematics.

**Theory of Probability and Mathematical Statistics** is the cover-to-cover translation into English of the TEORIJA VEROJATNOSTEĪ I MATEMATIČESKAJA STATISTIKA published by Kiev University, beginning with the 1970 Soviet publication.

**Vestnik of the Leningrad University (Mathematics)** is the complete translation into English of the mathematics section of the VESTNIK LENINGRADSKOGO UNIVERSITETA, beginning with the Soviet publication of 1968. All fields of mathematics are covered.

**BULLETIN of the American Mathematical Society** is being transformed during 1978 into the **BULLETIN of the American Mathematical Society—New Series**, which will begin volume 1 in January 1979. The two principal new features of the transformed **BULLETIN** will be: a continuing series of research-expository papers and the research announcements—new series. By the decision of the Council of the American Mathematical Society taken during its meetings of April 1977, August 1977, and January 1978, the **BULLETIN—New Series** will contain research expository papers (including obituary articles, Gibbs lectures, and retiring presidential addresses), book reviews, and a new series of research announcements under the direction and control of its own special editorial board. The new **BULLETIN** will continue to be a privilege of membership in the Society. The publication of **Research Announcements—New Series** will begin in January 1979 and the deadline for submission of announcements for the January issue will be August 15, 1978.

The following two statements give a more precise description of the two new features of the **BULLETIN**.

#### **RESEARCH ANNOUNCEMENTS—NEW SERIES**

The purpose of this department is to provide quick publication of new and significant results of interest to mathematicians. An editorial board will collectively choose approximately fifteen papers for each issue of the *Bulletin*. The deadlines for submission are: August 15 for the January issue, October 1 for the March issue, December 1 for the May issue, February 1 for the July issue, April 1 for the September issue and June 1 for the November issue. Members of the editorial board are: I. Kaplansky, R. P. Langlands, R. K. Lashof, H. P. McKean, H. L. Montgomery, C. S. Morawetz, D. Mumford, G.-C. Rota, I. M. Singer (Chairman), and E. M. Stein. Announcements are limited to 125 typed lines of 70 spaces each. Authors should send five copies of their manuscript (to speed the decision process) to I. M. Singer, Research Announcements Editorial Board, Mathematics Department, Evans Hall, University of California, Berkeley, CA 94720. Authors are requested to include an introductory paragraph intelligible to the nonexpert stating the nature and significance of their results. Sketches and/or ideas of proof must be included.

#### **RESEARCH-EXPOSITORY PAPERS**

Research-expository papers are by definition papers which present a clear and insightful exposition of significant aspects of contemporary mathematical research. These expositions should be in such a form as to be accessible and of interest to mathematicians, advanced students, and mathematically educated persons who are not specialists in the fields being presented. They should give motivation for the developments presented, interesting examples and connections to other fields, and a clear logical development including all the basic definitions. The editorial board as a whole will be responsible for the choice of articles to be published and will take an active role in insuring the expository mathematical quality of the papers. Members of the editorial board are: L. Bers, F. E. Browder (Chairman), P. J. Cohen, M. L. Curtis, F. W. Gehring, D. S. Ornstein, J. B. Serrin, S. Smale, and J. T. Tate. Authors should send manuscripts to Professor Felix Browder, Department of Mathematics, University of Chicago, 5734 University Ave., Chicago, IL 60637.



GEORGE A. HAGEDORN. Asymptotic completeness for a class of four particle Schrödinger operators .....	155
DAVID HANDELMAN AND JOHN LAWRENCE. Finite Rickart $C^*$ -algebras .....	157
MARC A. BERGER AND VICTOR J. MIZEL. A Fubini theorem for iterated stochastic integrals .....	159
ERIC K. VAN DOUWEN. Existence and applications of remote points.....	161
E. RODNEY CANFIELD. On a problem of Rota .....	164

# CONTENTS

January 1978

R. LASHOF. Equivariant smoothing theory .....	1
DAVID KINDERLEHRER. Variational inequalities and free boundary problems .....	7

## BOOK REVIEWS

STEPHANIE ALEXANDER. <i>A comprehensive introduction to differential geometry</i> by Michael Spivak .....	27
J. L. ALPERIN. <i>Modular representations of finite groups</i> by B. M. Puttaswamaiah and John D. Dixon .....	32
ANDREAS BLASS. <i>Applied nonstandard analysis</i> by Martin Davis; <i>Introduction to the theory of infinitesimals</i> by K. D. Stroyan and W. A. J. Luxemburg; and <i>Foundations of infinitesimal calculus</i> by H. Jerome Keisler .....	34
JERRY BONA. <i>Differential equations and their applications</i> by M. Braum .....	41
FRANK H. CLARKE. <i>Optimization, a theory of necessary conditions</i> by L. W. Neustadt; <i>Optimale steuerung diskreter Systems</i> by V. G. Boltjanski; and <i>The qualitative theory of optimal processes</i> by R. Gabasov and F. Kirillova .....	47
HARLEY FLANDERS. <i>Problems and theorems in analysis</i> by G. Pólya and G. Szegő ...	53
CHRISTOPH M. HOFFMANN. <i>Rekursive Funktionen in der Komputer Theorie</i> by Rózsa Péter .....	62
RICHARD B. HOLMES. <i>Applied functional analysis</i> by A. V. Balakrishnan .....	65
ROBERT C. JAMES. <i>Geometry of spheres in normed spaces</i> by Juan Jorge Schäffer ...	71
RAY A. KUNZE. <i>The theory of unitary group representations</i> by George W. Mackey ...	73
JACK OHM. <i>Geometric algebra over local rings</i> by Bernard R. McDonald .....	75
G. KREISEL. <i>Wittgenstein's lectures on the foundations of mathematics</i> by R. G. Bosanquet, Norman Malcolm, Rush Rhees and Yorick Smythies .....	79
O. T. O'MEARA. <i>The theory of numbers</i> by S. Iyanaga .....	90
S. ROSENBLAT. <i>Stability of fluid motions</i> . I, II by Daniel D. Joseph .....	96
MURRAY ROSENBLATT. <i>Measures on topological semigroups: Convolution products and random walks</i> by Arunava Mukherjea and Nicholas A. Tserpes .....	104
H. E. ROBBINS. <i>Adventures of a mathematician</i> by S. M. Ulam .....	107
COLIN BENNETT. <i>Interpolation spaces, an introduction</i> by Jöran Bergh and Jörgen Löfström .....	110
M. S. KLAMKIN. <i>Companion to concrete mathematics, Volumes I and II</i> by Z. A. Melzak .....	114
EDWARD NELSON. <i>Le mouvement brownien relativiste</i> by Jean-Pierre Caubet .....	121
P. M. COHN. <i>Grundzüge der universellen Algebra</i> by Herbert Lugowski .....	124

## RESEARCH ANNOUNCEMENTS

B. WEISFEILER. On Lie algebras of differential formal groups of Ritt .....	127
DANIEL ASIMOV. Average Gaussian curvature of leaves of foliations .....	131
F. R. COHEN AND L. R. TAYLOR. Configuration spaces: applications to Gelfand-Fuks cohomology .....	134
JOHN J. WALSH. Infinite dimensional compacta containing no $n$ -dimensional ( $n \geq 1$ ) subsets .....	137
MICHAEL P. DRAZIN. Natural structures on semigroups with involution .....	139
ALEXANDER D. IOFFE. Representation theorems for multifunctions and analytic sets ...	142
FRANK STENGER. Upper and lower estimates on the rate of convergence of approximations in $H_p$ .....	145
A. S. KECHRIS AND D. A. MARTIN. On the theory of $\Pi_3^1$ sets of reals .....	149
I. M. SIGAL. On quantum mechanics of many-body systems with dilation-analytic potentials .....	152